XII. *An attempt to correlate the results arrived at in recent Papers on the Classification of* Lepidoptera. By James William Tutt, F.E.S.

[Read Feb. 20th, 1895.]

The very interesting paper by Mr. George F. Hampson, "On recent contributions to the Classification of the Lepidoptera, by Prof. J. H. Comstock* and Dr. T. A. Chapman,"† which appeared in "The Annals and Magazine of Natural History" for October, 1894, has led me to pen the following notes.

The great advance which entomological, in common with other branches of natural, science has made during the last quarter of a century has revolutionised our ideas on the subject of classification. The old methods, in which the characters presented by the imago, were almost the only data utilised, have long been recognized as unsound. The great progress which has been made in the study of the immature stages of Lepidoptera, and the recognition of certain characters present in these stages as essential and important data, have brought about what may be called quite a new era in classification. The object of classification, I take it, is to place together those species which have most recently developed from the same stems; to work back, as far as may be, through the more recent stems to those less recent, and at last to that primeval form from which all have arisen. A system of classification, if it is to be a natural one, ought to be, when thoroughly worked out, a genealogical tree of the objects classified.

The embryological conditions (*i.e.*, those which precede the imago) are those which point out to us the past history of the insects, the changes through which they have passed in the course of their evolution, and, it must be evident, that such characters as may be found there, must be utilised if a scientific classification is to be

* "Evolution and Taxonomy," Wilder Quarter Century Book, Ithaca, N.Y., 1890, pp. 37–113.

† Trans. Ent. Soc. Lond., 1893, pp. 97–119; 1894, p. 335.

arrived at. No scheme based on a single set of characters, belonging to only one stage, can possibly be even approximately perfect. It is possible to conceive that, especially in those Orders where the method of life differs so greatly in the various stages and different means of defence and protection are thus rendered necessary, an insect may be very greatly modified in one particular stage, without any corresponding modification in the other stages being at all necessary. It may happen to be of advantage for the larva to be of a generalised type, and for the imago to be much more specialised, or *vice versa*. If this be granted, it follows that no scheme of classification that is not founded upon a consideration of the structural details and peculiarities of the insects in all their stages can be considered as really sound, or as founded upon a natural basis. It is also evident that the results of the various systems—whether based on oval, larval, pupal, or imaginal characters—must be compared, and the sum total of evidence brought together, if a satisfactory result is to be obtained. If these results agree, then it is clear that the conclusions arrived at are sound; but if the characters from one stage appear to suggest a different result from those obtained from another, it is evident that fresh observations and comparisons need to be made, and the differences to be explained before any adequate scheme can be reached. It is with a view of comparing, in some small degree, the results arrived at by Dyar (using larval characters), by Chapman (using pupal and larval characters), and by Comstock and Hampson (using imaginal characters) that the following notes are offered.

As is well known, in many Lepidoptera the wings are united by a "frenulum," or bristle, which is single in the male, but frequently more complex in structure in the female. This frenulum arises from the base of the costa of the hindwing, and articulates with the retinaculum on the underside of the forewing. In the *Hepialidæ* and *Micropterygidæ* the wings are united by a "jugum," or membranous lobe, which arises from near the base of the underside of the forewings. This jugum holds the base of the costal margin of the hindwing, as it were, in a vice, between itself and the inner margin of the forewing, a condition very similar to what obtains in the Trichoptera. These organs (the "jugum" and the

"frenulum") form, to a large extent, the basis of Professor Comstock's classification; his JUGATÆ containing the *Hepialidæ* and *Micropterygidæ*, whilst his FRENATÆ are divided roughly into "Generalised Frenulum Conservers," "Specialised Frenulum Conservers," and "Frenulum Losers."

It will be remembered that Dr. T. A. Chapman, from a study of the characters presented by the earlier stages (especially by the pupæ) of the Lepidoptera-Heterocera, divided them into two groups, OBTECTÆ and INCOMPLETÆ, and placed the *Micropterygidæ*, *Cochliopodidæ*, and *Hepialidæ* among the families which he considered to be at the bottom of the scale of development of the Lepidoptera; whilst it has long been known that the *Hepialidæ* and *Micropterygidæ* differed much from the other families of Lepidoptera, inasmuch as they possessed twelve veins in the hindwings, no other family having more than eight.

Since the publication of Professor Comstock's paper, Mr. Harrison G. Dyar, S.B., has worked out a general scheme of classification,* based on the arrangement and external structure of the setiferous tubercles of the larvæ of the Lepidoptera, in order "to see how a classification, based on these structures, would compare with this new classification." After pointing out that the special development of these tubercles is largely for the purpose of defence, and that, consequently, a classification based on larval tubercles might be expected to differ in important respects from one based on the adult insect, Mr. Dyar very rightly insists that the fact that his system does not differ in any important particulars "for the major groups" shows that Professor Comstock's classification is "the nearest to a natural one that we have yet had."

Owing to "the loss of the frenulum in certain *Frenatæ*," Prof. Comstock states that it is necessary to make use "of some other character or characters" which are acknowledged "by systematists as recognition characters." He then falls back upon neuration, a line which is worked out somewhat at length by Mr. Hampson in the paper referred to above.

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* "A Classification of Lepidopterous Larvæ," Annals New York Acad. Sci., viii., p. 18.

I may state at the outset, that this paper is not offered in a spirit of adverse criticism to any one of the particular lines indicated by, and worked out at length by, these various authors. My object is to point out where the different schemes of classification agree and where they differ, and to suggest some reasons for the more important points of difference. It is abundantly clear that, so far as the heterogeneous mixture, which has long since passed under the name of Tineina, is concerned, Dr. Chapman is the only author who has really faced the difficulty, or who has examined the material sufficiently to obtain even approximate results. The other heterogeneous group, Bombyces, has been well sifted by all the authors.

It is, of course, to be expected that some errors will be made, and some erroneous conclusions reached, by the study of any one set of characters separately; for it is only by a combination of many characters that we can ever reach a satisfactory classification. When, therefore, we find Chapman, Comstock, Dyar, and Hampson agreeing that the pupa, the jugum, the generalised condition of the setiferous tubercles of the larva, and the low developmental stage of the neuration all unite in indicating that the true place of the *Micropterygidæ* and *Hepialidæ* is at the bottom of the Lepidoptera, the conclusion must be looked upon as one not likely to be upset by the study of any other set of specialised characters, but, on the contrary, as one that will be rather strengthened thereby.

However satisfied we may be with regard to Comstock's Jugatæ, his subdivision of the Frenatæ into families which retain the frenulum, and families that tend to lose it, is not at all satisfactory. Mr. Hampson points out (Ann. Mag. Nat. Hist., p. 255) that this is not a natural arrangement, and indicates instances in various families of Lepidoptera in which certain genera have lost the frenulum, whilst the great mass of the genera (or species) in the family have retained it, *e.g.*: *Himantopterus* in the *Zygænidæ*; *Cleosiris* in the *Callidulidæ*; many genera in the *Drepanulidæ*, such as *Phalacra*, *Drapetodes*, *Oreta*, and *Ciliæ*; *Ratarda* in the *Lymantriidæ*; *Hypulia* and *Genusa* in the *Boarmiinæ*; and many genera of *Geometrinæ*. This arrangement struck me at once as being very similar to, and of much the same antiquated

character, as that by which one used to classify the Tortrices, according as they possessed, or did not possess, a costal fold. This primary division of the Frenatæ, therefore, appears to be unsatisfactory, perhaps, indeed, somewhat misleading, and Mr. Hampson and Mr. Dyar both very rightly regard the subdivision of the Frenatæ into "frenulum losers" and "frenulum conservers," as being decidedly faulty in many respects.

Mr. Dyar states that "the primitive form of tubercle consists of a little chitinous button on the skin bearing a single long hair . . . . It is found exclusively in the Jugatæ and *Psychidæ*." He, therefore, places the *Psychidæ* very low in the list, as low, in fact, as they were placed by Dr. Chapman for other reasons. Mr. Dyar then says that the remainder of the lepidopterous larvæ may be divided into two groups:—(1) Those which have a tendency to coalescence of tubercles iv. and v.* (= Professor Comstock's "Generalised Frenulum Conservers" plus one family each from his *Zygæninæ* and *Saturninæ*). (2) Those which have a tendency to the separation of tubercles iv. and v. (= Professor Comstock's "Specialised Frenulum Conservers" and "Frenulum losers" with the exceptions just noted). Mr. Dyar then says:—"If we shift the order of Professor Comstock's characters, and disregard the two exceptions, we may say that the first group corresponds to the 'Generalised Frenatæ,' the second to the 'Specialised Frenatæ.'" Hence we see that Mr. Dyar finds fault somewhat with the arrangement made by Professor Comstock, but as I have before pointed out, the Professor himself writes:—"The loss of the frenulum in certain Frenatæ renders necessary the use of some other character or characters by the systematists as recognition characters" (p. 45).

Mr. Dyar finds some difficulty in the correct understanding of the tubercles in many instances, for in the higher "Generalised Frenatæ," tubercle iv. has disappeared by coalescence with v., and in the higher "Specialised Frenatæ" it becomes smaller till it disappears, as may be seen in certain genera of the *Lymantriidæ*. "This illustrates," says Mr. Dyar, "the fundamental distinction that I have drawn between

* Tubercles iv. and v. appear from Dyar's figs. 3, 4, 5 (p. 198), to be the post-spiracular and the sub-spiracular tubercles respectively.

these groups. The distinction is still equally good theoretically, but it fails in practice. For this reason I have been in doubt about the position of the *Pyromorphidæ*, *Megalopygidæ* (= *Lagoidæ*), and *Eucleidæ* (= *Limacodidæ*), and I have been obliged to give weight to the characters of the moths in locating these families." Thus we see that Mr. Dyar draws his characters for locating these from the imagines, but he is at the same time careful to state that the "tubercles do not contradict the position assigned to them." Whether he is wise in doing this is open to question, but at the same time I cannot help thinking that in a classification based on larval characters, the consideration of the imaginal characters should have been abandoned, or, at least, only suggested.

Professor Comstock appears to fail to apply his own generalisations in some cases, the most remarkable instance being in connection with the *Syntomidæ*. The *Syntomidæ* are very like Zygænas in general appearance, the coloration and character of the spotting being often almost identical; yet the earlier stages prove that they are as far apart as two so closely similar groups of insects can be conceived to be. I had the pleasure of examining the larvæ and pupæ of *Syntomis* with Dr. Chapman, and there can be no doubt that, as Dr. Chapman has already pointed out, the *Syntomidæ* are to all intents and purpose Arctiids of a very high type, and that they have no connection with the *Zygænidæ* proper, whose Micro characters are well known to all British lepidopterists. The parallel system of coloration, markings, contour of wing, etc., in *Syntomidæ* and *Zygænidæ*, must have been evolved along perfectly independent lines. Professor Comstock correctly divides the *Zygænidæ* into two sections, but he has entirely failed to recognize the vast gulf that separates them.

Mr. Dyar places "the *Euchromiidæ* (= *Zygænidæ*)" with the Arctiids, and here the terminology appears somewhat to obscure the results; still there can be no doubt that he refers to our Syntomid group, for on p. 202 he writes of the superfamily *Zygænidæ*:—"So far as the North American fauna is concerned, there are but two families which claim notice, the *Euchromiidæ* and the *Pyromorphidæ*. According to my views these belong to two separate lines of descent, the "Specialised

Frenatæ" and the "Generalised Frenatæ" respectively. I will not do more here than call attention to this difference, as the *Pyromorphidæ* is one of the families about which I have been in doubt. From this there can be no doubt that Dyar correctly differentiates the *Euchromiidæ*, the Arctiid part of the so-called *Zygænidæ*, from the *Pyromorphidæ*, which represent the true Zygænas in America. If this be so, his conclusions are in agreement with those of Dr. Chapman.

The study of a group of insects from the point of view of any special structure deserves nothing but praise. Its utility is beyond all question; but generalisations based on such a study should be compared most carefully with results already obtained in other directions, in order to see that they do not widely disagree with them. If they do, the matter should be gone over again, with a view of showing either that the previous results are actually at fault or that there is an error in the present generalisation, for it may be regarded as certain, that any system, based on a really good, reliable, structural character will in the main agree with that ideal system which it is the desire of all scientific men to reach, which, based on a study of insects in all their stages, shall show us their lines of evolution and their present relations to each other.

The results submitted by Comstock, Hampson, and Dyar agree in one important particular, and that is, that they substantiate the apparently sweeping innovations which Dr. Chapman made as regards the relations of various families of Lepidoptera. Probably his paper was the most severe blow which the Bombyces, as a collective group, ever received, whilst it revolutionised our ideas of the Tineina. Lepidopterists, generally, recognized the heterogeneous mixture which these two groups presented, but what their real relationships were no one seemed able to point out. Some of the Bombyces, so-called, were transferred by Dr. Chapman to the lowest groups of the Lepidoptera; whilst some of the Tineina were shown to exhibit a strikingly high development. Unfortunately our American workers at this subject, as well as Mr. Hampson, appear to have found the Tineina too tough a task for their entomological digestion; it is to be hoped, however, that they will attack this part of the work from their own points of

view, and substantiate or upset Dr. Chapman's conclusions thereon.

On one point, however, all are agreed, and that is, that the *Micropterygidæ* and *Hepialidæ* come at the very bottom of the list, whilst these are followed by various families which have been hitherto placed high up in the scale. The following comparison of the results obtained by Dr. Chapman and Messrs. Hampson and Dyar, in that section called by Dr. Chapman Incompletæ, and by Professor Comstock subdivided into Jugatæ and Generalised Frenatæ, may prove interesting. There is really no need to place Comstock's detailed arrangement side by side with these, since Dyar says there are only two points in which his classification contradicts that of Comstock. One is the failure of Comstock to separate the *Euchromiidæ* [the Arctiid] and the *Pyromorphidæ* [the Zygænid groups of the *Zygænidæ*], the former of which belongs to Chapman's Obtectæ, the latter to his Incompletæ; the second is with regard to the *Lacosomidæ*, which are placed by Comstock with the *Saturnina*. Where Dyar differs from Chapman it is important to remember that in many instances Dyar's material has been very scanty.

The following tables speak for themselves as to the general agreement between the various authors:—

I. Classification based on pupal and larval characters.

Incompletæ, Chapman.

1. *Micropterygidæ, Cochliopodidæ, Zygænidæ.*
2. *a. Hepialidæ, Zeuzeridæ, Tischeria, Adelidæ, Nepticulidæ.*
   β. Tineidæ, Psychidæ, Sesiidæ, Tortricina, Cossidæ, Exapate, Simæthis [*Castnia*].
   γ. Lithocolletidæ, Gracilariidæ.
   δ. Pterophoridæ.

II. Classification based on the presence of a jugum or frenulum proposed by Comstock, these characters being supplemented by characters drawn from neuration. Same classification adopted by Dyar, whose conclusions are based on a study of the setiferous tubercles.

Jugatæ, Comstock, Dyar.

a. Micropterygidæ, Hepialidæ.*

Generalised Frenatæ, Comstock, Dyar.

a. Psychidæ.†

β. Cossidæ, Pyralidina, Tortricina, Tineina [*Gelechiidæ, Elachistidæ*], *Lacosomidæ,*‡ *Pterophoridæ, Pyromorphidæ,*§ *Megalopygidæ, Eucleidæ* [= the *Cochliopodidæ* (*Limacodidæ*)].

III. Classification by Hampson based on characters derived from neuration.

Incompletæ, Chapman.

1. *Micropterygidæ, Hepialidæ.*
2. *a. Limacodidæ* [*Cochliopodidæ*], *Zygænidæ, Castniidæ, Megalopygidæ, Psychidæ, Heterogynidæ, Cossidæ.*

   β. Sesiidæ, Tineidæ, Alucitidæ, Pterophoridæ.

Now, it must be admitted that no one knows better than the authors of these papers that it is impossible to arrange any of the families in linear order so that their relationship may be shown. Yet, in spite of this knowledge, there is a tendency, visible here and there, especially in Mr. Hampson's paper, to make a somewhat connected list, Mr. Hampson even going so far as to state that he has numbered the families "from the bottom upwards in what seems to be the most natural order of arrangement." Dr. Chapman very carefully avoids this, and only in the slightest degree does he even attempt to connect the families. He separates his Incompletæ, Section 2 (*vide ante*), as being developed on four separate lines, and shows that the line of development of each has in its own direction reached a high level. For example, he states that the *Zygænidæ* (Incompletæ, Section I.) must in many respects take a high

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* Not dealt with by Dyar.

† Considered as in the Frenatæ by Dyar, but not in Comstock's Generalised Frenatæ.

‡ Placed in *Saturniidæ* by Comstock.

§ Belongs to or closely allied to *Zygænidæ*, as limited by Chapman [excluding *Euchromiidæ*].

place. Thus, in comparing Sections 1 and 2, *Micropterygidæ* (Section 1) would fall below *Hepialidæ* (Section 2), but *Zygænidæ* (Section 1) would come above *Gracilariidæ*, and probably level with *Pterophoridæ* (Section 2), if the amount of specialisation of the groups be thoroughly weighed.

A comparison of the above tables shows how nearly Dr. Chapman's arrangement has been upheld by the other systems. It may be well now to point out the main differences observable, and, if possible, their causes. The greatest difference is, of course, at once noticed to be in connection with the TINEINA. Mr. Dyar's material here has been practically nil (*vide* Classif. of Lepidop. Larvæ, pp. 208, 209), whilst Mr. Hampson apparently includes all the groups in his *Tineidæ*, and gives no clue as to what he thinks of them. Both appear to come to conclusions practically at one with Dr. Chapman, so far as relates to the families hitherto lumped together as BOMBYCES, and, no doubt, when they have examined sufficient material in the TINEINA, they will confirm his conclusions there.

It would be well here to inquire what Mr. Hampson means by *Tineidæ*. Dr. Chapman restricts it very properly to the genus *Tinea* and its closest allies, and excludes absolutely all the other families formerly admitted under the name of TINEINA, which families, indeed, he shows to have a wonderful range of relationships. From the fact that one fails, in the remainder of Mr. Hampson's paper, to find any subsidiary groups, one is forced to the conclusion that he has included in the term the whole heterogeneous group, which I, for one, thought we had done with for ever; and as the TORTRICES are also left out of Mr. Hampson's arrangement, one wonders also whether they are, in addition, to be considered as included therein. Now, Dr. Chapman divides the TINEINA up into numbers of well-defined families, all having great and vastly different classificatory values (*vide* "Ent. Record," etc., vol. iv., pp. 73, 74), restricting the term *Tineidæ* to a very small section, as just defined. He subtracts, for example, the *Nepticulidæ*, the *Adelidæ*, and *Tischeria*, *Exapate*, the *Lithocolletidæ*, and *Gracilariidæ*, all of which fall in the large division INCOMPLETÆ. Then he further takes away the *Elachistidæ*, *Coleophoridæ*, *Argyresthidæ*, *Hypono-*

meutidæ, *Plutellidæ*, *Gelechiidæ*, and *Œcophoridæ*, which are placed with the Pyraloids in Obtectæ. When these have been taken away (and they are a fairly large share of the Tineina), Dr. Chapman uses the term *Tineidæ* for the remainder. Has Mr. Hampson examined these various groups thoroughly? If so, are we to assume that he has found characters which negative Dr. Chapman's treatment of them? Mr. Dyar subdivides them, but, on account of the slender material he has been able to obtain, his results are necessarily of the most incomplete nature.

The second difference is with regard to the *Alucitidæ* and *Pterophoridæ*. Dr. Chapman places the *Pterophoridæ* practically in the same position as does Mr. Hampson. The latter, however, places the *Alucitidæ* next to the *Pterophoridæ*. It would appear that in reality the *Alucitidæ* have no connection, near or remote, with the *Pterophoridæ* (perhaps, indeed, little more than the *Syntomidæ* have with the *Zygænidæ*); the superficial resemblance due to the plumose wings has been evidently reached along different lines of evolution, and does not appear to show a real relationship. In Dr. Chapman's arrangement, the *Pterophoridæ* are among the Incompletæ, whilst the *Alucitidæ* are placed in the Obtectæ. With regard to these two groups, Mr. Dyar appears to have made no differentiation.

The most startling result, however, is one reached by Mr. Dyar. He places the *Pyralidina* on the same line with *Cossus*, *Tortrices*, *Sesiidæ*, etc. It would appear, at first sight, that there must be something seriously amiss here, for Dr. Chapman and Mr. Hampson both bring the *Pyralidæ* into the Obtectæ. But after a little consideration I came to the conclusion that these great differences in position were more apparent than real. In his paper (Trans. Ent. Soc. Lond., 1893, pp. 108, 109) Dr. Chapman points out, that although the pupæ of his section *Pyraloids* have advanced a considerable distance along the line of evolution, so far, indeed, as to develop purely Macro (Obtectæ) characters, yet the larvæ retain many Micro (Incompletæ) peculiarities, as if the specialisation of the larva has not been so necessary, as has the independent specialisation of the pupa.

I am, of course, quite aware that the close examination of a large number of specimens of the smallest species,

comprised in what have been proved to be several important families, must occupy a vast amount of time. However, it is absolutely necessary that this should be done, because by bringing all the small Lepidoptera (Tineina, *Tortrices*) into one group, *Tineidæ*, as has been done by Mr. Hampson, the difficulty of their classification is very effectually, but unsatisfactorily, burked. Not, of course, that I think for a moment that Messrs. Hampson and Dyar foresaw this, for had they done so I feel satisfied that they would not have shirked the difficulty; still it wants facing, and the various groups, it appears to me, should be given their proper values in the tables drawn up by their respective authors.

Of the families that make up the division Obtectæ, Chapman (= the Specialised Frenatæ of Comstock), it is difficult to make a comparison. Dr. Chapman does not separate the families still left in Bombyces, nor does he indicate the difference in value of the several families so far as relates to their line of evolution. The failure, already referred to, of Mr. Dyar and Mr. Hampson to subdivide the Tineina into their component parts, gives no chance of obtaining their equivalent to Dr. Chapman's Obtectæ Section 3, including the *Hyponomeutidæ, Argyresthidæ, Coleophoridæ,* and ? *Elachistidæ.* Mr. Dyar, too, by placing the *Pyralidæ* in the Incompletæ withdraws this family from comparison, but Mr. Hampson agrees with Dr. Chapman in placing the *Pyralidæ* at the bottom of this group. Having reached this point Dr. Chapman is satisfied with naming the *Sphinges, Bombyces* (as restricted), *Nolidæ, Nyctæolidæ, Noctuina,* and *Geometræ,* collectively as the highest group, *i.e.*, those which have undergone the most specialisation. Both Mr. Hampson and Mr. Dyar agree with this, although their details are not identical. Mr. Dyar places the *Geometridæ* much lower than does Mr. Hampson, but, for all that, the important fact remains that all the authors' conclusions prove them to be in agreement that Dr. Chapman's *Macros* do represent the most highly developed families.

It may be interesting here to compare the details of classification suggested by these authors for the higher developed Heterocera.

I. Obtectæ, Chapman.
   1. Of doubtful value, *Coleophoridæ, Argyresthidæ, Hyponomeutidæ,* (*Elachistidæ* ?).
   2. Pyraloids.—*Alucitidæ, Epigraphiidæ, Œcophoridæ, Plutellidæ, Gelechiidæ, Crambidæ, Eudoridæ, Phycidæ, Pyrales.*
   3. Macros. — *Noctuina, Geometrina, Bombyces, Nolidæ, Nyctæolidæ.*

II. Specialised Frenatæ, Comstock, Dyar.
   1. *Noctuidæ* (in part), *Agaristidæ, Nycteolidæ* and *Nolidæ* [= *Lithosiidæ,* in part], *Notodontidæ, Geometridæ, Drepanidæ.*
   2. *Noctuidæ* (in part), *Pericopidæ, Arctiidæ, Euchromiidæ* [= *Zygænidæ* *], *Lymantriidæ, Lasiocampidæ, Sphingidæ* (?).

The *Lithosiidæ* † (in part), *Saturnina, Sphingidæ,* together with the various families of Butterflies, Dyar classes as the Frenulum Losers of Comstock.

III. Classification of Obtectæ, Chapman, as arranged by Hampson.
   1. *Pyralidæ, Thyridiidæ, Drepanulidæ, Callidulidæ, Lasiocampidæ.*
   2. *Arbelidæ, Endromidæ, Syntomidæ, Arctiidæ, Lymantriidæ, Pterothysanidæ, Hypsidæ, Agaristidæ, Noctuidæ.*
   3. *Cymatophoridæ, Sphingidæ, Notodontidæ, Dioptidæ, Geometridæ, Epiplemidæ, Uraniidæ, Epicopeidæ, Bombycidæ, Eupterotidæ, Ceratocampidæ, Brahmaeidæ, Saturniidæ, Rhopalocera.*

If we assume, and I think we may safely do so, that these groupings are not intended to be linear, we cannot help being struck with the fact that, to a considerable extent, even in detail, notwithstanding the comparatively small amount of material actually studied, the systems largely confirm each other.

It will be seen on reference to Mr. Dyar's paper that he has worked out the relationships of the larvæ of the

* This part of the old division of *Zygænidæ* is referred to the *Arctiidæ* by Chapman.

† There is no trace in Dyar's paper to show which part is here meant.

Rhopalocera on the same line as those of the Heterocera, and has attempted their classification by the larval characters he uses. Mr. Hampson has been satisfied to lump them at the end of his scheme. Dr. Chapman has recognized the necessity of treating the Butterflies separately in any scheme of classification that may be adopted, and has worked out a scheme for them based mainly on pupal characters. His detailed observations thereon were recorded in a paper read before the City of London Entomological Society, which will appear in print shortly (Ent. Record, March 15th and April 1st, 1895). To a great extent Mr. Dyar's subdivision of the various families indicates the main results at which Dr. Chapman has arrived, viz.—(1) The intimate connection between the *Nymphalidæ* and *Pieridæ* (quite a new idea); (2) the generalised condition of the *Papilionidæ*; (3) that each family contains within itself subfamilies indicating lower and higher lines of evolution, etc. Their main point of difference is in the position assigned to the *Hesperiidæ*. I may also mention here that Mr. Dyar accounts for only part of the *Lycænidæ*; he seems to have forgotten to indicate the position of the other part.

How far the neuration is useful or the reverse for a classification of this kind I am not prepared to say, Mr. Hampson's results in many ways prove that it has a value when properly applied, but I believe the lumping of the Rhopalocera under a single name, based on a character which associates the Butterflies nearly or remotely with *Geometridæ* and *Cymatophoridæ*, will tend to produce doubt in the minds of many as to whether the general similarity in neuration has in such cases the slightest classificatory significance. The same result has been arrived at, in the families indicated by Mr. Hampson, as forming the highest group, undoubtedly in many different ways; but I cannot agree that the neuration of the Rhopalocera, as a whole, conforms to the definition that the "Forewing has vein 5 arising from the middle of the discocellulars or nearer 6 than 4, the veins not arising at even distances around the cell." The examination of the neuration of the *Pieridæ* alone tends to show the almost absurdity of this character, and I have no doubt that the placing of the Rhopalocera here is almost on all fours with the placing of the *Tineidæ* as a whole in the lowest group.

I have no doubt that when Mr. Hampson works out the neuration of the Butterflies in detail, he will find sufficiently important characters to supplement and confirm the conclusions arrived at by Mr. Dyar and Dr. Chapman from larval and pupal characters.

Mr. Hampson does not tell us the reason for the irregularity of Nos. 10, 11, and 12 (pp. 258, 259) in his list. I would only mention with regard to 12 that the *Endromidæ*, as exemplified in the British *Endromis versicolor*, are an exception to the general definition which Dr. Chapman gives, viz., that, as pupæ, the OBTECTÆ have no power to emerge from the cocoon or to progress in any way, for the pupa of this species systematically forces itself out of the cocoon before the imago emerges. As a pupa, therefore, it comes (as regards this character) under Dr. Chapman's division INCOMPLETÆ; whether it fulfils the further conditions required to establish itself in this group, I have as yet failed to observe.

The vast amount of patient work necessary to produce a proportionately small show, should make us very thankful to those Entomologists who have recently paid attention to the subject of classification, and who have attempted to point out to us the natural lines on which it should go. Every scientific man has felt for many years that we really have had no system of classification except the hotch-potch, offered as such in synonymic lists; the authors of which have conscientiously done their best with a matter entirely outside their province. An attempt to compare the results already obtained by independent workers from the study of larvæ, pupæ, and imagines, and to show that the apparently revolutionary ideas enunciated by Dr. Chapman in your "Transactions" for 1893, have been confirmed by other observers, are my only excuses for bringing this paper before you to-night.